FUNDING REQUEST FOR BNL NEUTRINO FACTORY STUDIES

On p29, the APS Study of Neutrino Physics report **(The Neutrino Matrix)** it states that *A high-intensity neutrino factory or a Beta Beam facility is the ultimate tool in neutrino physics for the long term, and may be the only facility capable of definitively addressing some of the physics issues. For instance, only a Neutrino Factory would have the capability to observe* θ_{13}*, and study possible CP violation when the value of* $\sin^2(2\theta_{13})$ *is in the range between* 10^{-4} *to* 10^{-2}. The report states further that *The neutrino factory R&D program needs increased levels of support if the facility is to be realized in the long term.*

The Physics Department Advanced Accelerator Group is working on such R&D as part of the National Muon Collaboration (MC) with spokespersons S. Geer and R.B. Palmer, and Project manager M. Zisman. Currently, DOE M&S funding is administered by the project Manager, while a base of salaries and other expenses are administered by the individual institutions. The Muon Collaboration Oversight Group (MCOG) oversees this effort and, together with the collaboration spokespeople, is coordinating requests for additional support. This proposal is for additional funding for the base effort at BNL. Separate proposals are being prepared by FNAL and LBNL for support of their base effort, and by the project Manager for additional M&S funding.

Currently, the BNL Advanced Accelerator Group's main efforts are:

- Studies of high power targets, addressing both solid and liquid target materials. There is a world-wide effort to design and implement proton driver beams in the multi-MW class which can provide the basis for producing powerful, intense secondary beams. In particular, the BNL targetry program within the Muon Collaboration has developed a scenario for the production of intense muon beams based on immersing a high-Z liquid material (either Hg or Pb-Bi eutectic) within a high-field solenoid for the purpose of producing and capturing the soft pions generated when the proton beam interacts with the target. This effort includes a leadership role in the approved CERN experiment (nTOF11) to demonstrate the technical feasibility of a Hg jet target under conditions suitable for a Neutrino Factory. Since such work has such diverse applications, the proposal for additional funding is addressed in a sep-

arate section.

- Muon Acceleration studies using Non-Scaling FFAG's (Fixed Field Alternating Gradient). The idea for these accelerators arose from Neutrino Factory work and remains a component in the current US Neutrino Factory proposal. These accelerators may also have application for high repetition and high intensity proton accelerators and boosters. Since such work may have such wider application, the proposal for additional funding is addressed in a separate section.

- Theoretical studies of Neutrino Factory and Muon Colliders aimed at maximizing performance and minimizing cost. Work done this last year for the APS study showed how both neutrinos and antineutrinos could be generated from the same protons, and alternately sent to the detector. The effective performance was thus doubled. At the same time, the system was simplified and its cost reduced by about 40 %. These gains need engineering confirmation. The group is now involved in an International Scoping Study for a *World Design Study* (WDS) of Neutrino Factories, sponsored by RAL, that will further the work done by the MC Collaboration.

The BNL group, though small, is playing a leading role in the third item above, and represents over half the US effort. The addition of one staff member and one Post Doc would greatly expand these efforts and assure that the US remains, as it now is, the leader in such studies. Such an increment in personnel would partially correct the recent losses to US effort and stagnant budget of recent years. It was concern over such a trend that prompted the APS statements quoted above.

These studies will be needed for an extended period of time, until physics results can indicate the need for increased effort leading to a CDR, or until it is seen that the physics does not need such a facility.

The work will be done in collaboration with 6 US Labs, 17 US Universities, and 14 Foreign Institutions that form the Muon Collaboration. In addition, the work will be in partnership with the European Groups (CERN, RAL (UK), INFN, and Universities), Japan (KEK, Osaka, and Universities), and Russia (BINP).

This request is for:

3×300 k$ for one staff position

3×150 k$ for one Post Doc position